# HIV incidence in rural Malawi during widespread antiretroviral treatment availability

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## Background

In Malawi adult mortality and death attributable to HIV has fallen with widespread availability of antiretroviral treatment (ART) since 2005 and HIV prevalence approaches 8%. However the population impact on HIV incidence in this period is unclear.

## Methods

We used population-level demographic surveillance and annual socioeconomic and HIV sero-survey data from Karonga Prevention Study in rural Malawi, population 37,000, collected between 2007 and 2011. During four successive sero-surveys, 71%, 64% 65% and 62% of eligible adults (resident and aged 15 years and above), participated. Data from participants who tested in at least two sero-surveys, with an initial negative HIV test result were included in this analysis.




**Figure 1. Map of Malawi showing the location of Karonga Prevention Study Demographic Surveillance Site; a population of 37,000 living in 135km²**

We calculated crude age specific incidence rates and adjusted rate ratios (using Poisson regression) in adults aged 15 and above, by sero-survey round and socio-demographic factors, with adjustment for potential confounders.

## Results

During four years of follow up there were 95 new HIV infections (3.4 per 1000 person years (pyrs); 29 men and 66 women). The HIV incidence was 2.4 (95% CI 1.6-3.4 per 1000 pyrs) and 4.3 (95% CI 3.3-5.4 per 1000 pyrs) in men and women, respectively. Age specific rates are shown in Figure 1 and 2. Overall, roadside living was associated with a higher HIV incidence than rural residence (4.8 per 1000 pyrs vs. 2.5 per 1000 pyrs: adjusted rate ratio (RR) 1.77; 95% CI 1.16-2.73). Risk for HIV infection did not differ materially across surveys (p >0.05). The association between sex and HIV infection by cofactors is shown in Table 1. The association between marital status and HIV incidence was different for men and women (p=0.01), with never married women at increased risk for HIV infection compared with monogamously married women (RR 3.09; 95% CI 1.09-8.79) while never married men experienced reduced risk compared to monogamously married men (RR 0.02; 95% CI 0.0-0.24). Female manual workers, skilled and unskilled, experienced high rates of infection (16.9 per 1000 pyrs and 9.59 per 1000 pyrs; RR for skilled manual vs. farmer 4.29; 95% CI 2.07-8.86 and RR for unskilled manual vs. farmer 2.58; 95% CI 1.06-6.28).

**Age specific incidence rates (15+ years): Men**

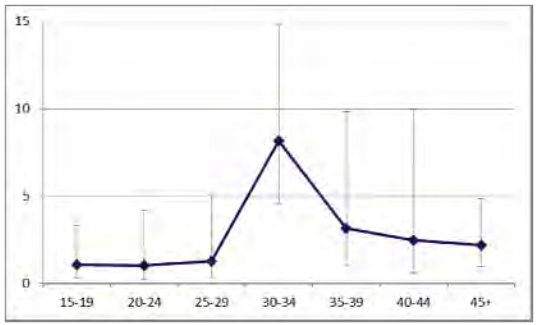



**Figure 1. Age specific incidence rates (per 1000 pyrs) in men**

**Age specific incidence rates (15+ years): Women**

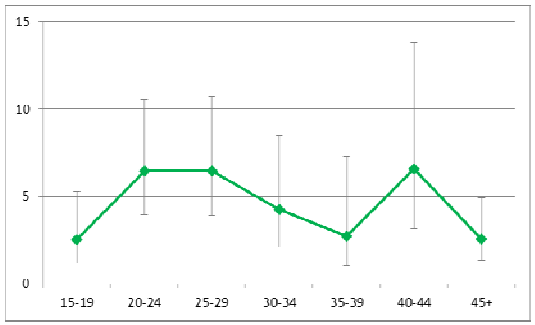



**Figure 2. Age specific incidence rates (per 1000 pyrs) in women**

**Table 1: HIV incidence rate ratios for men and women aged 15+ years by cofactors, 2007-2011**

| | Men | | | | | Women | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Person years | New infections | Crude incidence rate | Adjusted rate ratio [1] | 95% CI | Person years | New infections | Crude incidence rate | Adjusted rate ratio [1] | 95% CI | P heterogeneity[2] |
| **HIV sero-survey** | | | | | | | | | | | |
| Survey 1-2 | 3770 | 8 | 2.12 | 1 | | 4759 | 22 | 4.62 | 1 | | |
| Survey 2-3 | 4426 | 9 | 2.03 | 0.94 | 0.36, 2.47 | 5661 | 24 | 4.23 | 0.92 | 0.52 1.66 | |
| Survey 3-4 | 3937 | 12 | 3.05 | 1.35 | 0.54, 3.36 | 5086 | 20 | 3.93 | 0.82 | 0.44 1.52 | 0.48 |
| **Residency type** | | | | | | | | | | | |
| Rural | 7105 | 13 | 1.83 | 1 | | 8748 | 26 | 2.97 | 1 | | |
| Roadside | 5028 | 16 | 3.18 | 1.81 | 0.84, 3.94 | 6759 | 40 | 5.92 | 1.79 | 1.06, 3.01 | 0.66 |
| **Marital status** | | | | | | | | | | | |
| Married-monogamous | 4322 | 15 | 3.47 | 1 | | 6237 | 22 | 3.53 | 1 | | |
| Never married | 4062 | 1 | 0.25 | 0.02 | 0.00, 0.24 | 1907 | 10 | 5.24 | 3.09 | 1.08, 8.79 | |
| Married-polygnous | 316 | 2 | 6.34 | 1.90 | 0.43, 8.47 | 2041 | 9 | 4.41 | 1.32 | 0.60, 2.90 | |
| Married -unspecified | 2982 | 10 | 3.35 | 1.16 | 0.50, 2.70 | 2847 | 11 | 3.86 | 1.14 | 0.52, 2.50 | |
| Widowed | 141 | 0 | - | - | - - | 1258 | 4 | 3.18 | 1.23 | 0.37, 4.08 | |
| Divorced | 305 | 1 | 3.27 | 0.94 | 0.12, 7.21 | 1209 | 10 | 8.27 | 2.15 | 1.00, 4.62 | 0.01 |
| **Education** | | | | | | | | | | | |
| None/Primary 1-5 | 1054 | 2 | 1.90 | 1 | | 2461 | 9 | 3.66 | 1 | | |
| Primary 6-8 | 5608 | 14 | 2.50 | 1.03 | 0.23, 4.68 | 8855 | 38 | 4.29 | 0.77 | 0.35, 1.71 | |
| Secondary or higher | 5469 | 13 | 2.38 | 1.04 | 0.22, 4.97 | 4186 | 19 | 4.54 | 0.54 | 0.21, 1.35 | 0.88 |
| **Occupation** | | | | | | | | | | | |
| Farmer | 6403 | 17 | 2.65 | 1 | | 11605 | 36 | 3.10 | 1 | | |
| Student | 3515 | 3 | 0.85 | 1.58 | 0.24, 10.2 | 2092 | 8 | 3.82 | 1.43 | 0.43, 4.79 | |
| Professional | 373 | 0 | - | - | - - | 126 | 1 | 7.94 | 2.59 | 0.33, 20.3 | |
| Skilled manual | 695 | 3 | 4.32 | 1.17 | 0.33, 4.15 | 592 | 10 | 16.8 | 4.29 | 2.07, 8.86 | |
| Unskilled manual | 504 | 1 | 1.98 | 0.66 | 0.09, 5.04 | 626 | 6 | 9.59 | 2.58 | 1.06, 6.28 | |
| Small trader | 638 | 5 | 7.83 | 2.17 | 0.76, 6.14 | 454 | 4 | 8.82 | 2.33 | 0.82, 6.66 | 0.09 |

[1] Adjusting for age, residency type, marital status, sero-survey, education and occupation, as appropriate

[2] LR test for heterogeneity in the association between sex and cofactors including residency type, marital status, education and occupation

## Conclusions

In this rural population, rates of new infection are low and did not vary materially during 2007 to 2011 despite increasing availability of ART. However, rates are significantly higher in roadside dwellers and there is evidence for heterogeneity between men and women by marital status in the association with HIV infection. While the data are few, never married women are vulnerable to acquiring HIV infection in this population.

CROI, Seattle poster number: 1046